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drought

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Droughts are periods of abnormally dry weather that are sufficiently prolonged for the lack of precipitation to cause a serious imbalance in the HYDROLOGIC CYCLE. They result in water shortages, crop losses, reduced streamflow, diminished groundwater resources, and depleted soil moisture.

Droughts are distinguished from dry spells, which are periods of approximately 14 days with little or no precipitation. They may be classified according to climate conditions in the affected area. Thus permanent droughts exist where the climate is perpetually dry and agriculture can be carried out only with constant irrigation. Seasonal droughts exist where wet and dry seasons regularly alternate and farming, if done during the dry season, must also rely on irrigation. Contingent, or unpredictable, droughts exist where normally expected rainfall fails to occur, most characteristically in humid and subhumid areas; they tend to be most severe when they coincide with the increased water needs of the growing season and are thus the most serious of the physical hazards to farming. A fourth type of drought, called invisible drought, is harder to recognize. It occurs where precipitation fails to counterbalance the moisture lost by crops through evapotranspiration, and it makes itself felt by reduced crop yields rather than by wilting or some other observable form of crop damage.

Permanent drought occurs in two broad belts of high barometric pressure, one lying north and the other south of the equator. Atmospheric circulation in these areas is characterized by the descending phase of the circulation mechanism known as the HADLEY CELL. When moist tropical air descends, it becomes hotter and drier; and whenever this pattern of anticyclonic circulation persists, so does aridity. Contingent drought is most severe in areas bordering these zones of permanent drought.

Areas prone to contingent drought are found in West Africa, South Africa, Brazil, Australia, and India, and they tend to cluster in latitudes between 15 degrees and 20 degrees North and South. Droughts within these areas result from variations in the pattern of atmospheric circulation known as the WESTERLIES. A southward shift in the westerlies was responsible for the most severe drought (1968-74, mid-1980s) of the 20th century, which affected the West African region called the SAHEL. Because of this shift, the summer monsoon rains upon which the region depends missed the area entirely for years. The resulting droughts claimed hundreds of thousands of lives and killed nearly half of the region's livestock.

The effects of contingent drought have been less severe in mid-latitude regions, such as the United States. Droughts in such regions have been found to correspond to the location of disturbances of the JET STREAM that produce atmospheric patterns known as ROSSBY WAVES. Droughts of this type were experienced in the western and midwestern United States in the 1890s, 1930s, 1950s and late 1980s (see DUST BOWL).

Attempts have been made to identify cyclic drought patterns in Asia, Europe, and Africa, based on readings of tree rings, river levels, and lake sediments as well as on historical records, but they have been largely unsuccessful. Only in North America have researchers been able to detect some correlation between droughts and the cyclic phenomenon of sunspots. As revealed by tree-ring studies, both droughts and sunspots seem to recur at 20- to 22-year intervals in the western United States.

The effects of drought can be mitigated in a number of ways. Forecasts based on rainfall records can enable measures to be taken that will lessen the effects. Long-term measures include water conservation projects such as aquifer recharge and the construction of reservoirs. In addition, experiments in techniques of WEATHER MODIFICATION may hold promise for the future.

Peter Margolin

Bibliography: Bryson, R. A., and Murray, J. J., Climates of Hunger (1977); Korda, Viktor, Land Aridization and Drought Control (1980); Yevjevich, Vujica, ed., Coping with Droughts (1983); Wihite, D.A., et al., eds., Planning for Drought (1987).

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Droughts are distinguished from dry spells, which are periods of approximately 15 days with little or no precipitation. They may be classified according to climate conditions in the affected area. Thus permanent droughts exist where the climate is perpetually dry and agriculture can be carried out only with constant irrigation. Seasonal droughts exist where wet and dry seasons regularly alternate and farming, if done during the dry season, must also rely on irrigation. Contingent, or unpredictable, droughts exist where normally expected rainfall fails to occur, most characteristically in humid and subhumid areas; they tend to be more severe when they coincide with the increased water needs of the growing season and are thus the most serious of the physical hazards to farming. A fourth type of drought, called invisible drought, is harder to recognize. It occurs where precipitation fails to counterbalance the moisture lost by crops through evapotranspiration, and it makes itself felt by reduced crop yields rather than by wilting or some other observable form of crop damage.

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